

Title: In Vitro Disease Model of Microgravity Conditioning on Human Energy Metabolism
Author: Jessica Snyder
Date: December 2, 2010

In Vitro Biological Model of Microgravity Conditioning on Human Energy Metabolism

Jessica Snyder¹, C. Culbertson², Ye Zhang³, K. Emami³, H. Wu³, Wei Sun¹

¹Department of Mechanical Engineering, Drexel University

²Department of Chemistry, Kansas State University;

³NASA Johnson Space Center, Houston, TX

NASA and its partners are committed to introducing appropriate new technology to enable learning and living safely beyond the Earth for extended periods of time in a sustainable and possibly indefinite manner. In the responsible acquisition of that goal, life sciences is tasked to tune and advance current medical technology to prepare for human health and wellness in the space environment. The space environment affects the condition and function of biological systems from organ level function to shape of individual organelles. The objective of this paper is to study the effect of microgravity on kinetics of drug metabolism. This fundamental characterization is meaningful to (1) scientific understanding of the response of biology to microgravity and (2) clinical dosing requirements and pharmacological thresholds during long term manned space exploration. Metabolism kinetics of the anti-nausea drug promethazine (PMZ) were determined by an in vitro ground model of 3-dimensional aggregates of human hepatocytes conditioned to weightlessness using a rotating wall bioreactor. The authors observed up-regulated PMZ conversion in model microgravity conditions and attribute this to effect to model microgravity conditioning acting on metabolic mechanisms of the cells. Further work is necessary to determine which particular cellular mechanisms are governing the experimental observations, but the authors conclude kinetics of drug metabolism are responsive to gravitational fields and further study of this sensitivity would improve dosing of pharmaceuticals to persons exposed to a microgravity environment.